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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention dissolves gases, such as air and oxygen gas, in tap water, river water, other liquids, etc. efficiently, for example, purifies water quality, and belongs to the technical field of the detailed air-bubbles generator for reviving hydrological environment.

[0002]

[Description of the Prior Art] Most aeration by the detailed air-bubbles generator installed in the conventional aeration, for example, aquatic organism growth equipment tabular detailed air-bubbles generator pore to the shape of tubing and the air which were installed in the growth tub -- growth -- service water -- it being the method which subdivides air bubbles, or by the moving vane, a cellular jet, etc. by pressurizing inside and blowing off the growth in which shearing force was formed -- service water -- or [subdividing it by putting in air in a style] -- or it is the method which makes the air which was dissolving underwater evaporate and generates air bubbles with sudden reduced pressure of the pressurized water. And although required accommodation is fundamentally performed by the amount of feeding of air, the facility number of each detailed air-bubbles generator, etc., it needs to be efficient to underwater and it is necessary to dissolve gases, such as air and carbon dioxide gas, in it, and to promote a hydrologic cycle further in the aeration by the detailed air-bubbles generator which has those functions.

[0003]

[Problem(s) to be Solved by the Invention] However, the aeration method by the conventional detailed air-bubbles generator For example, however it may prepare detailed pore there by the aeration method depended for blowing off Air bubbles blow off from pore in the state of pressurization, and carry out cubical expansion. With moreover, the surface tension of the air bubbles in that case It is difficult to generate the big air bubbles which have an about several mm diameter as a result, and to generate air bubbles smaller than it, and the problem of increase of the blinding generated with the long duration operation and power expense existed. Moreover, by the method which puts in air in the stream in which shearing force was formed, and subdivides it by the moving vane, a cellular jet, etc., the high-speed engine speed was required of generating cavitation, there were the corrosion and the oscillating problem of a wing which advance rapidly with the problem of the power expense or cavitation generating, and there was also a problem that there were still few yields of detailed air bubbles. And in the method with which vapor-liquid two-phases flow collides with other moving vanes or a projection, fishes and an aquatic life I object will be destroyed [, for example / in a lake and a fishes tank etc.], and trouble was caused to formation of an environment required for growth of an aquatic organism, and maintenance again. Furthermore, by the pressurization method, equipment was large-sized and running cost also needed the large sum for the high price and the pan. and the above -- it was impossible to have generated detailed air bubbles called the diameter of 20 micrometers or less on a scale of industry with any conventional technique, for example.

[0004]

[Means for Solving the Problem] this invention person made it possible wholeheartedly to generate detailed air bubbles with a diameter of 20 micrometers or less on a scale of industry by invention of the following configuration as a result of research. As the principle explanatory view of this invention equipment is shown in drawing 12 , the main point of this invention provides the tooth space 100 of a cone form in an equipment container first, establishes the pressurization liquid inlet 500 to a part of wall periphery side of this tooth space in the tangential direction, and establishes the gas installation hole 80 in the center section of the tooth-space pars basilaris ossis occipitalis 300 of said cone form, forms the revolution vapor-liquid derivation opening 101 near the crowning of said cone tooth space further, and constitutes a detailed air-bubbles generator. then, said body of equipment -- or by making the revolution vapor-liquid derivation opening 101 lay underground into a liquid at least, and feeding a pressurization liquid in the cone tooth space 100 from said pressurization liquid inlet 500, a revolution style generates to the interior and a negative pressure part is formed on a cone tube axis. When a gas is inhaled from said gas installation hole 80 by this negative pressure and a gas passes through a tube-axis top with the lowest pressure with it, the thin revolution gas cavernous section 60 is formed. In this

cone tooth space 100, the revolution rate of flow and the rate of flow which goes to an outlet increase to coincidence, so that a revolution style is formed toward an outlet (revolution vapor-liquid derivation opening) 101 from an entry (pressurization liquid inlet) 500 and faces to the revolution vapor-liquid derivation opening 101 according to the pinch of a tooth space 100. Moreover, although centripetal force works with a centrifugal force at a liquid, and works into a gas at coincidence, therefore it becomes separable [the liquid section and the gas section] from the specific gravity difference of a liquid and a gas, a gas continues to an outlet 101 by the shape of yarn and it blows off from there with this revolution, by surrounding ****(water), that revolution can weaken rapidly to that jet and coincidence, and a rapid swing-speed difference occurs before and behind that in them. The gas cavernous yarn-like section 60 is stabilized continuously, and is cut by generating of this swing-speed difference, a lot of detailed air bubbles as that result, for example, detailed air bubbles with a diameter of 10-20 micrometers, are generated in the said outlet 101 neighborhood, and it is emitted into the liquid besides a vessel. As shown, for example in drawing 6 , according to another mode, moreover, inside the roofed cylinder object 4 of a gradual extension reverse cone (truncated cone) configuration The revolution rise water style 20 of the circumference partial 4a, and the revolution descending water liquid flow 22 of the part of the inside, The revolution style of Mie of revolution cavernous section 23** of the negative pressure for the core is formed. In the revolution cavernous section 23 of the negative pressure When forming the gas vortex tube 24 which carries out revolution descent and emitting through the downward central reflux opening 6, elongating and making [make it accumulated,] the self-priming gas 26 and the elution gas component 27 taper off, resistance of an emission path is received, a swing-speed difference is generated, the gas vortex tube itself is cut compulsorily and detailed air bubbles are generated.

[0005] That is, the configuration of this invention is as follows.

(1) The revolution type detailed air-bubbles generator characterized by coming to consist of the body of a container which has the tooth space of a cone form, a pressurization liquid inlet established by the tangential direction in a part of wall periphery side of this tooth space, a gas installation hole established by the tooth-space pars basilaris ossis occipitalis of said cone form, and revolution vapor-liquid derivation opening established by the crowning of said cone tooth space.

(2) The revolution type detailed air-bubbles generator characterized by coming to consist of the body of a container which has the tooth space of a truncated-cone form, a pressurization liquid inlet established by the tangential direction in a part of wall periphery side of this tooth space, a gas installation hole established by the tooth-space pars basilaris ossis occipitalis of said truncated-cone form, and revolution vapor-liquid derivation opening established in the upper part of said truncated-cone form tooth space.

(3) The revolution type detailed air-bubbles generator characterized by coming to consist of the body of a container which has the tooth space of a bottle configuration or a wine bottle configuration, a pressurization liquid inlet established by the tangential direction in a part of wall periphery side of this tooth space, a gas installation hole established by the tooth-space pars basilaris ossis occipitalis of said bottle configuration or a wine bottle configuration, and revolution vapor-liquid derivation opening which were established by the crowning of the tooth space of said bottle configuration or a wine bottle configuration.

(4) A revolution type detailed air-bubbles generator given in any 1 term of the preceding clauses 1-3 characterized by the pressurization liquid inlet established in the tangential direction keeping spacing on the wall periphery of the same curvature, and coming to prepare them to a part of wall periphery side of a tooth space. [two or more]

[0006] (5) A revolution type detailed air-bubbles generator given in any 1 term of the preceding clauses 1-4 characterized by the pressurization liquid inlet established in the tangential direction keeping spacing on the wall periphery of different curvature, and coming to prepare them to a part of wall periphery side of a tooth space. [two or more]

(6) A revolution type detailed air-bubbles generator given in any 1 term of the preceding clauses 1-5 to which a pressurization liquid inlet is characterized by coming to be established in a part of wall periphery side near the pars basilaris ossis occipitalis of said tooth space.

(7) A revolution type detailed air-bubbles generator given in any 1 term of the preceding clauses 1-6 to which a pressurization liquid inlet is characterized by coming to be established in a part of wall periphery side near the mountain side section of said tooth space.

(8) A revolution type detailed air-bubbles generator given in any 1 term of the preceding clauses 1-7 characterized by coming to arrange a baffle in the direct anterior part of revolution vapor-liquid derivation opening.

(9) The water style revolution installation structure of the circular hold room of a lower circulation base, and the revolution rise water style formation structure formed in the upper part put on the upper part at the circumference part inside the roofed cylinder object of a gradual extension configuration, The revolution descending water liquid flow formation structure formed in the part inside the circumference part, The revolution cavernous section of the negative pressure formed in a part for the core of this roofed cylinder object of the ***** segregation of the revolution rise water style and a revolution descending water liquid flow, The gas part by which elution was carried out to the self-

priming ***** gas out of the revolution stream from gas self-priming tubing attached in the revolution cavernous section of this negative pressure focusing on the top cover is accumulated. The gas vortex tube formation structure as for which the expanding and tapering off become as [form / tapering off / the gas vortex tube which carries out revolution descent is formed, and], and when the gas vortex tube which develops, tapers off, turns and descends carries out revolution inrush at central reflux opening of the pars basilaris ossis occipitalis of a circular hold room, The detailed gassing structure of receiving **** of an emission path, falling the swing speed, generating a swing-speed difference, and the gas vortex tube of the said division being cut compulsorily, and generating detailed air bubbles, The revolution type detailed air-bubbles generator characterized by coming to consist of revolution jet emission structures which it had as [make / include the generated detailed air bubbles in a revolution descending water liquid flow, and / it / emit out of a vessel from side-face emission opening as a revolution jet].

[0007] (10) The revolution type detailed air-bubbles generator of the publication by the preceding clause 9 carry out [coming to have in the water style revolution installation structure of the circular hold room which cut a circular hold room in the upper part of a lower circulation base, and connect a pump to the introductory tubing and becomes this circular hold room by carrying out as / carry out / energization revolution installation of the water style / while carrying out opening of the water style inlet to a tangential direction from the side to this inner skin, and] as the description. (11) Put the roofed cylinder object of a gradual extension configuration on erection upwards in the upper part of said circular hold room. Make the revolution installation style of a lower circular hold room feed, carry out the revolution rise of the circumference part inside this roofed cylinder object, and a revolution rise water style is made to form. The revolution rise water style which reached the upper limit is flowed back into the part inside the circumference part. The preceding clause 9 which is made to carry out revolution descent and is characterized by coming to prepare the duplex revolution water style formation structure of a revolution descending water liquid flow for the revolution rise water style list inside the roofed cylinder object of a **** configuration to the upper part which becomes by carrying out as [make / a revolution descending water liquid flow / form], or a revolution type detailed air-bubbles generator given in 10.

(12) By the ***** segregation of the revolution style of the duplex of the revolution rise water style inside the roofed cylinder object of the aforementioned gradual extension configuration, and a revolution descending water liquid flow The revolution cavernous section of negative pressure is formed in a part for the core, and the gas component by which elution was carried out to the revolution cavernous section of this negative pressure from the self-priming gas and this revolution style is accumulated. A revolution type detailed air-bubbles generator given in the preceding clause 11 characterized by coming to have the gas vortex tube formation structure as for which the gas which carries out revolution descent while making it elongate and taper off becomes as [form / gas].

(13) While ****(ing) central reflux opening focusing on the pars basilaris ossis occipitalis of said circular hold room When the gas vortex tube which comes to carry out the drilled hole of the emission path from this reflux opening towards side-face emission opening of this circulation base, and carries out revolution descent while elongating and making the amount of [inside this roofed cylinder object] core taper off rushes in and flows into central reflux opening, Receive resistance of an emission path, fall the swing speed, and a swing-speed difference is generated between the upper and lower sides of the vortex tube. A revolution type detailed air-bubbles generator given in the preceding clause 9 characterized by coming to have the detailed gassing structure which becomes as [generate / a vortex tube is cut compulsorily and / by the speed difference, / detailed air bubbles] thru/or any 1 term of 12.

[0008] (14) Carry out the drilled hole of two or more side-face emission openings to the aforementioned central reflux opening at a radial. In order of the revolution direction, from central reflux opening, the gas vortex tube which carries out the revolution descent of the part for the core of the aforementioned roofed cylinder object is turned to the two or more side-face emission opening, and is sent in. Between the revolution Generating of the aisle resistance by the collision to the side attachment wall of reflux opening which adjoins generating of the aisle resistance by sending to side-face emission opening A revolution type detailed air-bubbles generator given in the preceding clause 9 which is made to repeat alternately with multiple times and is characterized by coming to have the structure of a vortex tube as for which detailed air bubbles become as [generate / generate a swing-speed difference up and down, and / air bubbles / cut a vortex tube and] each time thru/or one term of 13.

(15) The preceding clause 13 characterized by imitating in the revolution style formation direction of said roofed cylinder inside of the body, and for the communication trunk for the emission it was connected [emission / opening / of said circulation base / side-face emission] bending the emission direction, and making it come to protrude, or a revolution type detailed air-bubbles generator given in 14.

(16) The body of a container which has the tooth space of a cone form, and the pressurization liquid inlet established by the tangential direction in a part of wall periphery side of this tooth space, A detailed air-bubbles generator is constituted from a gas installation hole established by the tooth-space pars basilaris ossis occipitalis of said cone form, and revolution vapor-liquid derivation opening established by the crowning of said cone tooth space. Ubukata from revolution type detailed air bubbles characterized by making into the 1st process formation of a gas vortex tube which

carries out revolution derivation, elongating, and tapering off and carrying out in said cone tooth space, and making generating of the detailed air bubbles by generating a swing-speed difference between before and behind the gas vortex tube, and making a gas vortex tube cut compulsorily into the 2nd process -- law.

[0009]

[Embodiment of the Invention] The gestalt of operation of this invention is explained based on a drawing below. As the principle explanatory view of this invention equipment is shown in drawing 12, the tooth space 100 of a cone form is first provided in an equipment container, the pressurization liquid inlet 500 is established to a part of wall periphery side of this tooth space in the tangential direction, and the gas installation hole 80 is established in the center section of the tooth-space pars basilaris ossis occipitalis 300 of said cone form, the revolution vapor-liquid derivation opening 101 is further formed near the crowning of said cone tooth space, and a detailed air-bubbles generator consists of this inventions. then, said body of equipment -- or by making the revolution vapor-liquid derivation opening 101 lay underground into a liquid at least, and feeding a pressurization liquid in the cone tooth space 100 from said pressurization liquid inlet 500, a revolution style generates to the interior and a negative pressure part is formed on a cone tube axis. When a gas is inhaled from said gas installation hole 80 by this negative pressure and a gas passes through a tube-axis top with the lowest pressure with it, the thin revolution gas cavernous section 60 is formed. In this cone tooth space 100, the revolution rate of flow and the rate of flow which goes to an outlet increase to coincidence, so that a revolution style is formed toward an outlet (revolution vapor-liquid derivation opening) 101 from an entry (pressurization liquid inlet) 500 and faces to the revolution vapor-liquid derivation opening 101 according to the pinch of a tooth space 100. Moreover, although centripetal force works with a centrifugal force at a liquid, and works into a gas at coincidence, therefore it becomes separable [the liquid section and the gas section] from the specific gravity difference of a liquid and a gas, a gas continues to an outlet 101 by the shape of yarn and it blows off from there with this revolution, by surrounding ***** (for example, water), that revolution can weaken rapidly to that jet and coincidence, and a rapid swing-speed difference occurs before and behind that in them. The-gas cavernous yarn-like section 60 is stabilized continuously, and is cut by generating of this swing-speed difference, a lot of detailed air bubbles as that result, for example, detailed air bubbles with a diameter of 10-20 micrometers, are generated in the said outlet 101 neighborhood, and it is emitted into a liquid out of a vessel.

[0010] As shown, for example in drawing 6, according to another mode, moreover, inside the roofed cylinder object 4 of a gradual extension reverse cone (truncated cone) configuration The revolution rise water style 20 of the circumference partial 4a, and the revolution descending water liquid flow 22 of the part of the inside, The revolution style of Mie of revolution cavernous section 23** of the negative pressure for the core is formed. In the revolution cavernous section 23 of the negative pressure When forming the gas vortex tube 24 which carries out revolution descent and emitting through the downward central reflux opening 6, elongating and making [make it accumulated,] the self-priming gas 26 and the elution gas component 27 taper off, resistance of an emission path is received, a swing-speed difference is generated, the gas vortex tube itself is cut compulsorily and detailed air bubbles are generated.

[0011] Drawing 12 is the theoretic explanatory view of this invention equipment, the (a) Fig. is a side elevation and the (b) Fig. is an A-A cross section of the (a) Fig. The configuration of this invention equipment provides the tooth space 100 of a cone form in the body container of equipment, establishes the pressurization liquid inlet 500 to a part of wall periphery side of this tooth space in the tangential direction, and establishes the gas installation hole 80 in the center section of the tooth-space pars basilaris ossis occipitalis 300 of said cone form, and has formed the revolution vapor-liquid derivation opening 101 near the crowning of said cone tooth space further. in addition -- usually -- the body of this invention equipment -- or the revolution vapor-liquid derivation opening 101 at least is buried and installed into a liquid. This invention is circumscribed to the case where the body of equipment is buried and installed into a liquid, and a tank, and may be installed. In this invention, although water is adopted as a liquid and air is adopted as a gas, usually In addition to this as a liquid, solvents, such as toluene, an acetone, and alcohol, petroleum, Food and drinks, such as fuels, such as a gasoline, edible oil and fat, butter, ice cream, and Biel, Environmental water, such as health supplies, such as chemicals, such as drinkable preparations, and bath water, lake water, and septic tank polluted water, etc. is employable. In addition to this as a gas, alkaline gas, such as sour gases, such as oxidizers, such as inert gas, such as hydrogen, an argon, and a radon, oxygen, and ozone, carbon dioxide gas, a hydrogen chloride, a sulfur dioxide, nitrogen oxide, and hydrogen-sulfide gas, and ammonia, etc. is employable. Moreover, in drawing, the pressure of the revolution liquid circles [P_a] in a cone tooth space, the pressure of revolution gas circles [P_b], the pressure of the revolution gas circles [P_c] near gas induction, the pressure of the revolution gas circles [P_d] near an outlet, and P_e are the pressures of outlet section revolution liquid circles.

[0012] Then, from said pressurization liquid inlet 500, into the cone tooth space 100, the revolution rate of flow and the rate of flow which goes to an outlet increase at coincidence, so that a revolution style is formed toward the revolution vapor-liquid derivation opening 101 from an entry 500 and goes to an outlet 101 by feeding a pressurization liquid to a tangential direction according to cross-section contraction. Moreover, with this revolution, into a gas, centripetal force will work at coincidence, therefore a centrifugal force will become a liquid separable [the liquid section and the gas

section], and a negative pressure gas will appear from the specific gravity difference of a liquid and a gas in it continuously to an outlet 101 by the shape of yarn. Then, a gas is automatically inhaled from said gas installation hole 80' (self-priming), and in a revolution vapor-liquid style, a gas serves as the thin revolution cavernous section 60, and is incorporated. In this way, although the thin gas revolution cavernous section 60 of the shape of yarn of a core and the liquid revolution fluid of the circumference of it blow off from an outlet 101, by surrounding *****, the revolution can weaken rapidly to the jet and coincidence, and a rapid swing-speed difference occurs before and behind that in them. The gas cavernous section 60 of the shape of yarn of a revolution style core is stabilized continuously, and is cut by generating of this swing-speed difference, and a lot of minute air bubbles as that result, for example, detailed air bubbles with a diameter of 10-20 micrometers, are generated in the said outlet 101 neighborhood.

[0013] In drawing 12, the desirable correlation relational expression of the aperture d1 of the revolution vapor-liquid derivation opening 101, the aperture d2 of the cone tooth-space pars basilaris ossis occipitalis 300, the aperture d3 of the gas installation hole 80, and the distance L between the revolution vapor-liquid derivation opening 101 - the cone tooth-space pars basilaris ossis occipitalis 300 is $d2/d1 \times 10^{-15}$ and $L \times 1.5 - 2.0 \times d2$, and the numerical range by the difference in a model is as follows.

	d ₁	d ₂	d ₃	L
大型装置	1.3~2.5 c m	22~35 c m	2.6~3.5 mm	38~70 c m
中型装置	5.5~12.0 mm	10~21 c m	1.3~2.5 mm	15~36 c m
小型装置	2.0~4.5 mm	2.0~5.0 c m	0.7~1.2 mm	3.5~10.0 c m
超小型装置	1.5 mm 以下	0.7~21.5 mm	0.3~1.0 mm	1.2~3.0 c m

In addition, in the case of the medium size (for example, a pump), it was a motor 2kw and 200l. heads [of discharge quantity / a part for /and 40m of heads] thing, and it could use this, and could generate detailed air bubbles in large quantities, and the detailed bubble with a thickness of about 1cm deposited it on the whole water surface of the tank of 5m three volume during operation. This equipment was applicable to water quality purification of a with a 2000m volume [or more 3] pond. Moreover, when small, pumps are about w, and 20l. the thing for /of motor 30 discharge quantity, and have been used within the volume of 1-30m about 3 tank using this. In addition, when it applies to seawater, since it is very easy to generate detailed air bubbles (microbubble), it is possible to expand a service condition further. Drawing 15 is the graphical representation having shown the diameters and those generating frequency distribution of air bubbles of the result of having made the medium size equipment of this invention of drawing 12 buried underwater, having adopted [result] air as a gas, and having generated detailed air bubbles. In addition, the result at the time of carrying out by adjusting the amount of air drawing from the gas installation tubing 80 was also shown. Among drawing, even when the amount of intake of air is set to 0cm³/s, it is guessed that it is what the air dissolved underwater separated and generated that air bubbles with a diameter of 10-20 micrometers are generated. Therefore, this invention equipment can be used also as a deaerator of a dissolved gas.

[0014] In this way, install this invention equipment into a liquid, for example, pass the pressurization liquid installation tubing 50 through a storage pump. Supply a pressurization liquid (for example, pressure water) in the cone tooth space 100 from the pressurization liquid inlet 500, and from the exterior gas installation tubing (for example, air pipe) only by connecting with the gas inlet 80 It can set in a liquid (for example, water), and detailed air bubbles with a diameter of about 10-25 micrometers can be generated and supplied easily. In addition, whenever said tooth space is shown in the thing of the shape of a cylindrical shape to which a diameter becomes large gradually (or it becomes small), for example, drawing 14, it may come, and you may not necessarily be the thing of a cone configuration and it may be the thing of a bottle configuration or a wine bottle configuration. Moreover, the generating situation of air bubbles can be controlled by accommodation of the valve for gas flow regulation (not shown) which connected at the tip of the gas installation tubing 80, and can control easily generating of the optimal detailed air bubbles for which it asks. This accommodation can be made to also generate simply still larger air bubbles than the diameter of 10-20 micrometers. Control of the diameter of generating air bubbles can generate detailed air bubbles with a magnitude of about hundreds of micrometers in the condition of not reducing a 10-20-micrometer microbubble extremely.

[0015] Moreover, drawing 13 prepares the pressurization liquid installation tubing 50 and 50' near the pars-basilaris-ossis-occipitalis 300 side of a tooth space, and before the revolution vapor-liquid derivation opening 101 (namely, the wall periphery top of the curvature from which a wall periphery side differs -- spacing -- placing -- a tangential direction -- two or more -- preparing), and is **. By enlarging sharply the liquid introducing pressure force from left-hand side pressurization liquid inlet 500' rather than the introducing pressure force from the right-hand side pressurization liquid inlet 500, and supplying a liquid, it is that of the peach which is greatly going to raise the number of revolution of a left-hand side liquid, and is going to promote cellular generation much more more detailed than the result. In this way, the air bubbles of the particle size of arbitration are generable by adjusting the pressure of the pressure water from both pressurization liquid inlet 500,500'. In addition, 200 is a baffle plate (baffle) and it is useful to promoting generation and

diffusion of detailed air bubbles.

[0016] Next, the detailed air-bubbles generator in another mode of this invention is explained. The front view of the generator of the revolution type detailed air bubbles of this invention example and drawing 2 drawing 1 The top view, Drawing 3 is the central drawing of longitudinal section (B-B sectional view of drawing 2), and drawing 4 is the cross-sectional view (A-A sectional view of drawing 1) of the lower circulation base. The explanatory view of the revolution style of Mie [in / in drawing 5 / the X-X cross section inside a cylinder object], the explanatory view of a revolution rise-and-fall style [in / drawing 6 is the same and / a Y-Y cross section], and a gas vortex tube, The explanatory view of detailed gassing structure in case the explanatory view of detailed gassing [in / in drawing 7 / a gas vortex tube] and drawing 8 have four side-face emission openings, The explanatory view of generating structure [in / in drawing 9 / the 1st side-face emission opening of drawing 8], the explanatory view of the generating structure in the side attachment wall with which drawing 10 adjoins the 1st side-face emission opening of drawing 8 , and drawing 11 are the explanatory views of the generating structure in the 2nd side-face emission opening, and drawing 16 is an installation condition explanatory view in the tank of this equipment. the inside of drawing, and 1 -- a revolution type detailed air-bubbles generator and 2 -- a lower circulation base and 3 -- a circular hold room and 4 -- a roofed cylinder object and 5 - a water style inlet and 6 -- central reflux opening and 7 -- for a revolution rise water style and 22, as for the revolution cavernous section of negative pressure, and 24, a revolution descending water liquid flow and 23 are [side-face emission opening and 8 / gas self-priming tubing and 20 / a gas vortex tube and 25] the cutting sections.

[0017] The water style revolution installation structure of making the circular hold room 3 of the lower circulation base 2 carrying out energization revolution installation of the water style like illustration when the structure of the revolution type detailed air-bubbles generator 1 of this invention is divided roughly, The revolution rise water style formation structure which was put on the upper part of this circular hold room 3 and which is formed upwards at circumference partial 4a inside the roofed cylinder object 4 of a gradual extension configuration (reverse cone configuration), By the ***** segregation of the revolution style of the duplex of the revolution descending water liquid flow formation structure formed in partial 4b inside this circumference partial 4a, and the this the revolution rise water style 20 and the revolution descending water liquid flow 22 The formation structure of the gas vortex tube 24 which carries out revolution descent while the self-priming gas 26 and the elution gas 27 are accumulated on the revolution cavernous section 23 of the negative pressure formed in the core part 4c, and the revolution cavernous section 23 of this negative pressure, and it is formed at them and made to elongate and taper off, The detailed gassing structure which becomes as [generate / the vortex tube 24 is cut compulsorily and / receive resistance, when the gas vortex tube 24 rushes into the central reflux opening 6, generate a swing-speed difference between vertical 24a of the vortex tube, and b, and / detailed air bubbles], The generated detailed air bubbles are included in the style of revolution descending water, and it consists of revolution jet emission structures which it had as [make / it / emit out of a vessel from the side-face emission opening 7 as a revolution jet].

[0018] Moreover, the circular hold room 3 is cut in the center of the upper part of the cube-like lower circulation base 2, and opening of the water style inlet 5 is carried out to inner skin 3a of this circular hold room 3 from the side to this inner skin 3a in the tangential direction. moreover, in conduit tube splicer 5a which protruded on the outside intake of this inlet 5 The conduit tube 10 which attached the pump 11 (drawing 16) and flow control valve 12 (you may arrange not out of underwater but out of a vessel) for water supply on the way is connected. Energization installation of the water style is carried out from a counterclockwise tangential direction at inner skin 3a of this circular hold room 3, and it has become as [form / in the direction of D of illustration (counterclockwise rotation) / a revolution installation style].

[0019] Moreover, the straight cylinder configuration part 42 of the barrel lower limit section is fitted in the upper part step from which said circular hold room 3 was released, and the roofed cylinder object 4 which formed the barrel in the gradual extension reverse cone configuration upwards toward the top is stood straight and put on it. 41 is self-priming ***** about a gas to the revolution cavernous section 23 of the negative pressure formed in core part 4c which is been the flat top cover, and it turns caudad on the medial axis (C-C) of the top cover 41, and the gas suction pipe 8 is inserted, and is mentioned later. Moreover, like ****, the vapor-liquid interflow by which revolution installation was carried out in the direction of D **** is fed into the interior of this roofed cylinder object 4, maintaining the revolution energization force, carries out the revolution rise of the internal circumference partial 4b, and forms the revolution rise water style 20 in the circular hold room 3. Moreover, after this revolution rise water style reaches the upper limit of the cylinder object 4 and setting it to partial 4b inside the circumference partial 4a reflux 21 along with the inner skin of the barrel of a gradual extension configuration, increasing a swing speed gradually, it begins revolution descent, and it forms the revolution descending water liquid flow 22. Next, by the ***** segregation of the revolution style of the duplex of the revolution rise water style 20 and the revolution descending water liquid flow 22, the revolution cavernous section 23 of negative pressure is formed in core part 4c of the cylinder object 4.

[0020] The revolution descending water liquid flow 22 which carries out the revolution descent of the revolution cavernous section 23 and the perimeter of this negative pressure that carries out revolution descent becomes as

[reduce / each internal pressure / conversely] while accelerating each swing speed by narrowing since the revolution downward field on a medial axis (C-C) is the reverse cone configuration of the cylinder object 4. Therefore, although it is elongated, and the configuration of the revolution cavernous section 23 of core part 4c tapers off and turns, with the expanding, internal pressure declines increasingly and elution of the air contained in the stream comes to be carried out from the revolution descending water liquid flow 22 which circles in the surroundings. Moreover, on the other hand, the gas self-priming tubing 8 is revolution cavernous minded [of the aforementioned negative pressure which carries out revolution descent / 23], and air is self-priming *****. While this self-priming gas 26 and the elution gas 27 from the aforementioned revolution style develop and make the revolution cavernous section 23 of negative pressure accumulate and taper off, the gas vortex tube 24 which carries out revolution descent is formed.

[0021] Detailed air bubbles are not generated only in formation of the gas vortex tube 24 which carries out the revolution descent of the medial-axis (C-C) top. As shown in drawing 7, to the gas vortex tube 24, it uses resistance of the emission path, generates a swing-speed difference among the upper and lower sides 24a and 24b of the gas vortex tube 24, the detailed air-bubbles generator 1 of this invention is the process emitted out of a vessel through the central reflux opening 6, twists the gas vortex tube 24 compulsorily, makes it cut, and it is constituted so that detailed air bubbles may be generated. Moreover, the gas vortex tube 24 can serve as good conditions for formation of detailed air bubbles, so that the diameter of the cross section is thin. moreover, the thing for which control of this cross-section diameter operates the self-priming amount of the air from the gas self-priming tubing 8 by the flow control valve 12 -- (drawing 16) -- it is easily controllable. The cross-section diameter of a gas vortex tube becomes large, and when a self-priming amount is zero, it serves as min, so that there are many self-priming amounts of air. In addition, although formed only with the elution gas 27 from the revolution descending water liquid flow 22 of the above [the gas vortex tube 24] at the time of self-priming gas zero, in water quality purification of the sanitary sewage with little dissolved oxygen, the cautions about purification capacity are required. By the above, the generating structure of the detailed air bubbles in this invention equipment 1 Within the roofed cylinder object 4, formation of the gas vortex tube 24 which carries out revolution descent is made into the 1st process. It is characterized by constituting generating of the detailed air bubbles by generating a swing-speed difference by resistance of the emission path among the upper and lower sides 24a and 24b of a vortex tube, twisting compulsorily the gas vortex tube 24 which carries out revolution descent while making it elongate and taper off, and making it cut as the 2nd process.

[0022] Moreover, as an emission path for emitting the revolution descending water liquid flow 22 which carries out the revolution descent of the inside of the cylinder object 4 out of a vessel, on the medial axis (c-c) of pars-basilaris-occipitalis 3b of the downward circular hold room 3, central reflux opening 6 is ****(ed) by the vertical and the drilled hole of the four side-face emission openings 7 is further carried out to the radial towards four side faces of the lower circulation base 2 with this equipment 1 from this central reflux opening 6. The detailed air bubbles generated by cutting of the aforementioned gas vortex tube 24 which carries out revolution descent are emitted out of a vessel through four side-face emission openings 7 from the central reflux opening 6 with the revolution descending water liquid flow 22. Moreover, the stream then emitted turns into the emission jet 28 which circles while the revolution force had been energized, and is emitted. Detailed air bubbles are generated also as the detailed air bubbles generated by cutting of the gas vortex tube 24 which these side-faces emission opening 7 may not be plurality, and the number of them may be one, and makes central reflux opening 6 tapering off, and carries out revolution descent from there to a true direct lower part, without forming the side-face emission opening 7, and a method which emits the revolution descending water liquid flow 22.

[0023] Based on the explanatory view shown in drawing 8 - drawing 11, the generating structure of the detailed air bubbles when having four side-face emission openings 71, 72, 73, and 74 to the central reflux opening 6 is explained below. With the revolution descending water liquid flow 22, the gas vortex tube 24 which carries out the revolution descent of the core part 4c of the aforementioned roofed cylinder object 4 is the sequence of the revolution direction (D view), and is sent in towards four side-face emission openings 71, 72, 73, and 74 from the central reflux opening 6. Drawing 9 shows the condition of being emitted to the 1st side-face emission opening 71. Lower 24b of a gas vortex tube reduces the swing speed in response to the aisle resistance by the sending, a swing-speed difference is generated between up 24a of a gas vortex tube, and a vortex tube twists, is cut and generates detailed air bubbles. 25 shows the cutting section. Drawing 10 shows the condition of having received the aisle resistance which collides with reflux opening side-attachment-wall 6a which the gas vortex tube 24 adjoins at the following 2nd side-face emission opening 72 in the middle of other. By colliding with side-attachment-wall 6a, lower 24b of a gas vortex tube changes a swing speed, and generates detailed air bubbles similarly in the cutting section 25. Drawing 11 shows the condition that the gas vortex tube 24 is emitted to the 2nd emission opening 72, it serves as a different swing speed from the time of drawing 10, generates the cutting section 25, and generates detailed air bubbles. Like the above, emission to four side-face emission openings 71, 72, 73, and 74 and the collision to each adjoining side-attachment-wall 6a are alternately repeated 4 times between 1 revolution, a swing-speed difference is generated among the upper and lower sides 24a and 24b of a vortex tube, a vortex tube is cut, and a lot of detailed air bubbles are generated each time.

[0024] Moreover, the number of the side-face emission opening 7 is related to the revolution style 22, the number of revolution of the gas vortex tube 24, and the number of the cutting sections 25. In order to make the high number of revolution possible, it is necessary to make the revolution installation of the water carry out in early stages with the pump of the high-pressure force. As the number of revolution is increased, the cutting section (field) 25 becomes small, and the elution of the gas by negative pressure becomes remarkable, and it becomes more possible to generate smaller more a lot of detailed air bubbles. Moreover, the number of detailed air bubbles increases also by increasing the number of the side-face emission opening 7. Although it turned out from the experimental result that the optimal emission talkative is related also to the amount of water installation under the fixed rotational frequency, an emission talkative has four optimal pieces a part for 40l./, and about head 15m.

[0025] Moreover, although the communication trunk 9 for emission is connected [a / of the side-face emission opening 7 of said lower circulation base 2 / outlet 7] the revolution style formation rectangle within said roofed cylinder object 4 (the direction of D view) -- imitating -- the emission direction -- D -- 45 degrees being bent, and to the direction indicated by the arrow, since it protrudes When the revolution type detailed air-bubbles generator 1 of this invention is installed in a tank 13 (drawing 16), The circulating flow of the D **** direction is generated around this revolution type generator 1 emitted as a revolution jet into a tank 13 from the communication trunk 9 for emission, and the detailed air bubbles containing oxygen become as [distribute / in a tank 13 / air bubbles / equally]. With the above-mentioned example equipment 1 of this invention configuration, the stream containing the detailed air bubbles with which 10-20 micrometers of diameters of air bubbles occupy 90% or more from emission opening was emitted. In addition, although the lower circulation base 2 has a desirable ingredient with weight when installing in a tank 13, in made from plastics, the stainless steel plate which has weight in the pars basilaris ossis occipitalis further may be stuck. Moreover, when the roofed cylinder object 4 is constituted from a transparent material, it has the advantage on which formation of an internal revolution rise water style etc. and formation of those downward reflux are observed.

[0026] Moreover, the components of this invention equipment may be plastics, a metal, glass, etc., and it is desirable to unify each component part by adhesion, screwing, etc. The following is mentioned as an application field of the detailed air bubbles generated by this invention equipment.

** . Natural environment purification maintenance by water quality purification of a water area and habitation living thing training of a dam lake, a lake, a pond, a river, the sea, etc.

** . Living thing training of the purification and the firefly in artificial natural water areas, such as a biotope, an aquatic plant, etc.

** . Industrial use.

Aeration to the polluted water in the organic substance removal in the promotion ultrapure water plant of the acid cleaning of the formation of elevated-temperature diffusion in steel manufacture of iron manufacture, a stainless plate, and a stainless steel line, the organic substance removal in the polluted water by the formation of detailed air bubbles of ozone, the increment in the amount of dissolved oxygen, sterilization, synthetic-resin foam, for example, urethane foam manufacture, various waste fluid processings, the mixed promotion to the water of the ethyleneoxide in the sterilization and sterilization equipment by ethyleneoxide, emulsion-izing of a defoaming agent, and an activated-sludge-treatment method.

** . Improvement in the rate of improvement / harvest of the oxygen used for agricultural field hydroponics and the amount of dissolved oxygen.

** . Training of culture of a fishery field eel, cuttlefish water thecodont life maintenance, culture of buri, artificial generation of a submarine forest, and fish and shellfishes, outbreaks-of-res-tide prevention.

** . It applies to medical field organ bath water, and they are a configuration, blood-flow promotion, and incubation of organ bath water about a detailed bubble bath.

[0027]

[Effect of the Invention] According to the revolution type detailed air-bubbles generator of this invention, it is size the place which contributes the manufacture for equipment structure can generate detailed air bubbles easily on a scale of industry, and comparatively small and easy is easy, and effective in culture of water quality purification of a pond, a lake, a dam, a river, etc., the sewage disposal by the microorganism, fishes, an aquatic animal, etc.

[Translation done.]